

# Types of mixtures

Water, the life-sustaining resource, can be obtained from a variety of sources. Rain is obviously water, and many people collect rainwater from their roofs. The ocean is a very large body of water, as are rivers, seas and lakes. Farmers often have dams to store water in. There is even water underground. In developed countries many people have water supplied to them by pipes. None of the water from any of these sources is pure water. They are all a mixture of water and various impurities. In order to make the water safe to drink, it is important to know what the impurities are and how to remove them if required.

## Solutions

**Solutions** are a type of mixture. In fact, they are what we call a **homogeneous mixture**, meaning that they are the same throughout. A solution is made up of one substance (the **solute**) dissolved in another substance (the **solvent**). For example, if you make a cup of instant coffee you would dissolve the coffee and sugar in water. The water would be the solvent and the coffee and sugar would be the solutes. The cup of coffee is the solution. If you took a sample of the coffee from anywhere in the cup it would always be the same. Although solutions may vary in their colour, all solutions are clear and it is possible to shine a light through them.

## Solubility

The **solubility** of a substance is defined as the amount that will dissolve in a particular volume at a particular temperature. For example, 35.9 grams of sodium chloride (table salt) will dissolve in 100 cubic centimetres (cm<sup>3</sup>) of water at 25°C. If a solution has this amount of solute dissolved, we call it a **saturated solution**. If there is less than this amount, then it is an **unsaturated solution**. This means that more solute can still be dissolved. Under certain conditions, extra solute can be dissolved. When this occurs it produces a **supersaturated solution**.

The type of solute and solvent will affect the amount that dissolves. If something does not dissolve, it is **insoluble** in that solvent. Think about a piece of metal. If you were to put it in a beaker of water, nothing would happen – it is insoluble in water. However, if you were to put a sugar cube into water, it would dissolve – it is **soluble** in water.



FIGURE 5.4

Various solutions: (a) vinegar, (b) squash or cordial, (c) seawater

### Area of interaction

#### Community and service

Many international aid agencies, such as Water Aid, support communities around the world so that they can have access to clean, safe drinking water. Research more about the work that these agencies do. They depend upon people's support for their work. What could you do to support this work? Perhaps you could organise some activities at your school on World Water Day (22 March).



## Explaining solutions using particle theory

Particle theory states that matter is made up of particles that are in constant motion. You may remember from *Science 1 for the international student* (Unit 5, Particles on the move) that these particles are atoms or molecules. In a solution, when the solute dissolves in the solvent, the particles of the solute are separated and spread out evenly throughout the solution.

### Why do some substances dissolve and not others?

When a solute dissolves in a solvent, it needs to be attracted to the solvent. That attraction needs to be strong enough to separate the solvent molecules and the solute molecules. Sugar will dissolve in water because the sugar molecules are attracted to the water molecules. This is enough for the water to pull sugar away from other sugar molecules.

By comparison, oil and water will not dissolve, or even mix. This is because the oil molecules and water molecules are only very weakly attracted to each other. The oil prefers to stay with other oil molecules, and the water prefers to stay with other water molecules. We say that they are **immiscible** and they will form two separate layers rather than mixing together.

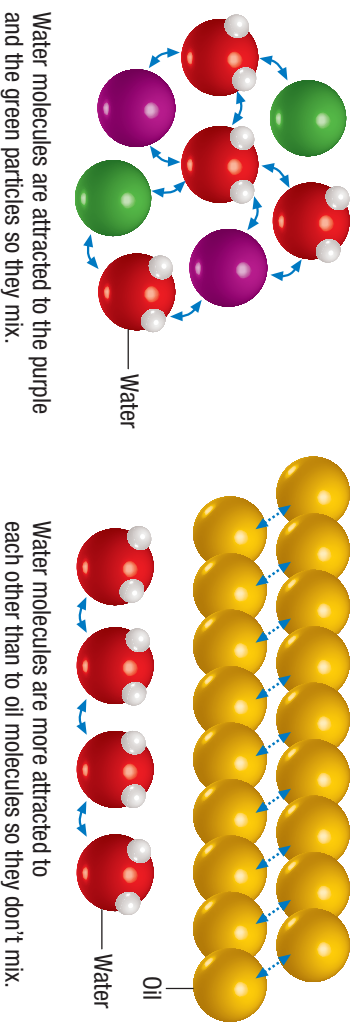


FIGURE 5.5

Water is choosy about what it mixes with

## Suspensions

Sometimes one substance is mixed into another and initially it looks as if it has dissolved or spread throughout the solvent. But if it is left for a while, a layer forms on the bottom or top. Muddy water is an example of this. When a substance is suspended in a solvent for a time before it eventually settles, the mixture is called a **suspension**. The solid that settles at the bottom of a liquid is called the **sediment**.

### Explaining suspensions using particle theory

In a suspension, the atoms and molecules are insoluble and so they do not dissolve. The atoms and molecules join together in bigger particles (clumps). Because they are heavy, they will eventually sink to the bottom of the liquid.



FIGURE 5.6

A snow dome contains a suspension.

## Investigation 5.1

### How quickly do substances dissolve?

#### Your challenge

To investigate the factors that affect the speed at which substances dissolve. Your task is to choose one factor that affects this speed of dissolving. You will need to plan, conduct and evaluate an investigation to determine the effect of this factor. As you are planning, think about aspects such as how you will measure when the substance has dissolved, the solute and solvent you will use, and how much of the chosen solute and solvent you will use. You will also need to consider the other variables that may change your results and how will you control them.

#### This might help

The speed at which a substance dissolves in a solvent is dependent on a number of factors, such as temperature, the size of the pieces of the substance, and whether it is stirred.

Carry out and write up your investigation following the guide in the Appendix of this book or as advised by your teacher.

## Experiment 5.1

### Make glitter slime

#### Materials

- half a cup of cornflour
- two drops of food colouring
- half a teaspoon of glitter
- one tablespoon of water
- stirring rod
- 250 cm<sup>3</sup> beaker

#### Procedure

- 1 Add the flour, then the glitter, then food colouring, then the water to the beaker. Stir the mixture quickly, then slowly, with the stirring rod.
- 2 The slime you have made is a suspension of cornflour and glitter in water. When left to drip, it is slimy, but put under pressure or stretched, it becomes harder. Work it gently. What is it like?

